



DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[RTID 0648-XC766]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Construction of Liquefied Natural Gas Platforms off Louisiana

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from New Fortress Energy Louisiana FLNG LLC (NFE) for authorization to take marine mammals incidental to construction of liquefied natural gas platforms off Grand Isle, Louisiana. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-time, one-year renewal that could be issued under certain circumstances and if all requirements are met, as described in **Request for Public Comments** at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than [*insert date 30 days after date of publication in the FEDERAL REGISTER*].

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service and should be submitted via email to *ITP.clevenstine@noaa.gov*.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period.

Comments, including all attachments, must not exceed a 25-megabyte file size. All comments received are a part of the public record and will generally be posted online at *<https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities>* without change. All personal identifying information (e.g., name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Alyssa Clevenstine, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *<https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities>*. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the “take” of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical

region if certain findings are made and either regulations are proposed or, if the taking is limited to harassment, a notice of a proposed IHA is provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other “means of effecting the least practicable adverse impact” on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stocks for taking for certain subsistence uses (referred to in shorthand as “mitigation”); and requirements pertaining to the mitigation, monitoring and reporting of the takings are set forth. The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an IHA) with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 (IHAs with no anticipated serious injury or mortality) of the Companion Manual for NOAA Administrative Order 216-6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On October 7, 2022, NMFS received a request from NFE for an IHA to take marine mammals incidental to pile driving associated with construction off the southeast coast of Grand Isle, Louisiana. Following NMFS' review of the application, NFE submitted a revised version on February 3, 2023, which was deemed adequate and complete. NFE's request is for take of bottlenose dolphin (*Tursiops truncatus*) by Level B harassment only. Neither NFE nor NMFS expect serious injury or mortality to result from this activity and, therefore, an IHA is appropriate.

Description of Proposed Activity

Overview

NFE proposes to construct the Louisiana FLNG Project, a deepwater port export terminal in West Delta Lease Block 38 approximately 12 nautical miles (nm; 22 kilometers (km)) off the southeast coast of Grand Isle, Louisiana, in approx. 26-28 meters (m; 85-91 feet (ft)) of water (Figure 1). NFE intends to use impact pile driving to install 26 steel piles, each 108 inch (in; 2.743 m) in diameter, to support three fixed-jacket platforms. Impact pile driving activities would occur for a total of 9 days (three days per platform) anytime from May through August 2023. NFE has requested authorization to incidentally take one species (two stocks) of marine mammal by Level B harassment only. Take would potentially result from exposure to sounds produced by impact pile driving and is expected to produce short-term and localized impacts in the form of behavioral harassment of marine mammals located in the project area. No injury or mortality is expected and none is proposed to be authorized.

NFE also plans the following: trench for pipeline laterals; construct and install two pipeline laterals (24 in, 20 in diameter) and tie-ins to an existing offshore natural gas

pipeline; setting of three self-elevating platforms; and anchoring for a floating liquefied natural gas storage unit (FSU) and service vessel buoys. No take of marine mammals is anticipated to occur incidental to all other portions of the project (pipelines, self-elevating platform installation, anchoring for FSU construction activities), and these activities will not be discussed further.

Dates and Duration

This IHA would be effective from May 1, 2023 until April 30, 2024. Impact pile driving activities would occur for a total of 9 days from May–August 2023. NFE plans to conduct impact pile driving during daylight hours, with pile installation beginning no earlier than one hour after (civil) sunrise and no later than 90 minutes (min) before (civil) sunset.

Specific Geographic Region

The project will be located within the Gulf of Mexico (GOM), approx. 12 nm (22 km) off the southeast coast of Grand Isle, Louisiana, at a depth of 26-28 m (85-91 ft; Figure 1). All project activities for which take is being requested will be located in Outer Continental Shelf West Delta Lease Block 38. For the immediate project area, the sea floor is expected to be predominantly clay with sediment layers as follows: clay (0-19 m), clay-silt (19-54 m), and sand (54 m).

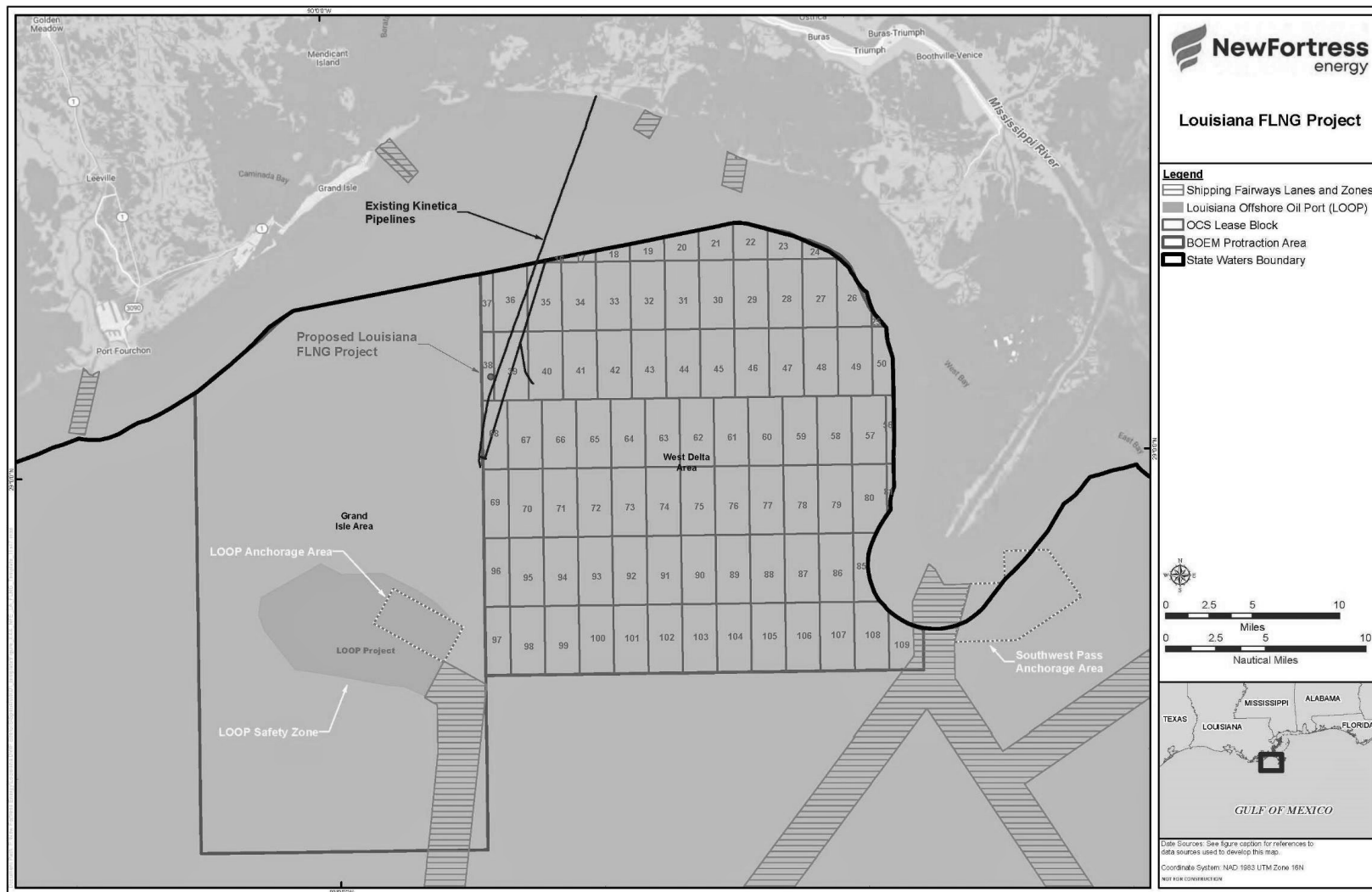


Figure 1. Project Area Map

Detailed Description of the Specified Activity

Impact pile driving of 26 steel piles, each 108 in (2.743 m) in diameter, to support three fixed-jacket platforms (P4, P5, P6) would occur over 9 days (3 days per platform). Piles would be driven sequentially and the number of piles driven per day would vary between the three platforms (Tables 1, 2). Hammer blows per day are based on daylight-only operations with a single hammer, spread evenly across the construction window. 9 days of active pile driving are estimated to drive all 26 piles. Estimated hammer blows vary from 3,942 to 7,144 per day depending on platform and pile segment being driven (piles in P5 and P6 are assembled from three separate segments).

Table 1. Pile Driving Specifications for the Three Fixed-Jacket Platforms

Platform	Number of piles	Length of pile (feet)	Diameter of pile (inches)	Depth of penetration (feet)	Estimated hammer blows (total)	Estimated hammer blows (per pile)
P4	12	385	108	260	17,052	1,421
P5	8	405	108	280	19,136	2,392
P6	6	345	108	220	14,352	2,392

Note: Hammer blows per pile vary with length of pile and depth of penetration.

Table 2. Pile Driving Progression Summary

Platform	Pile segment	Hammer energy (percent)	Hammer energy (kilojoules)	Duration (minutes)²	Blows per minute	Total number of blows¹	Total number of blows per day
P4	P1	20	460	36.53	30	1,096	5,684
P4	P1	40	920	42.93	30	1,288	5,684
P4	P1	60	1,380	110.0	30	3,300	5,684
P5	Day 1: P1	20	460	85.6	30	2,568	5,256
P5	Day 1: P1	40	920	89.6	30	2,688	5,256
P5	Day 2: P1+P2	20	460	17.07	30	512	6,736
P5	Day 2: P1+P2	40	920	22.67	30	680	6,736
P5	Day 2: P1+P2	60	1,380	184.8	30	5,544	6,736
P5	Day 3: P1+P2+P3	20	460	52.8	30	1,584	7,144
P5	Day 3: P1+P2+P3	40	920	22.4	30	672	7,144
P5	Day 3: P1+P2+P3	60	1,380	162.93	30	4,888	7,144
P6	Day 1: P1	20	460	64.2	30	1,926	3,942
P6	Day 1: P1	40	920	6.2	30	2,016	3,942
P6	Day 2: P1+P2	20	460	12.8	30	384	5,052
P6	Day 2: P1+P2	40	920	17	30	510	5,052
P6	Day 2: P1+P2	60	1,380	138.6	30	4,158	5,052
P6	Day 3: P1+P2+P3	20	460	39.6	30	1,188	5,358
P6	Day 3: P1+P2+P3	40	920	16.8	30	504	5,358
P6	Day 3: P1+P2+P3	60	1,380	122.2	30	3,666	5,358

¹ Total number of blows are based on the total number of piles installed per day.

² Duration provided for all piles within a 24-hour period.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see **Proposed Mitigation** and **Proposed Monitoring and Reporting**).

Description of Marine Mammals in the Area of Specified Activities

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species. NMFS fully considered all of this information, and we refer the reader to these descriptions, incorporated here by reference, instead of reprinting the information. Additional information regarding population trends and threats may be found in NMFS' Stock Assessment Reports (SARs; www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments) and more general information about these species (e.g., physical and behavioral descriptions) may be found on NMFS' website (<https://www.fisheries.noaa.gov/find-species>).

Table 3 lists all stocks for which take is expected and proposed to be authorized for this activity, and summarizes information related to the population or stock, including regulatory status under the MMPA and Endangered Species Act (ESA) and potential biological removal (PBR), where known. PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no serious injury or mortality is anticipated or proposed to be authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species or stocks and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' U.S. Atlantic and GOM SARs. All values presented in Table 3 are the most recent available at the time of publication (including from the draft 2022 SARs) and are available online at: www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.

Table 3. Species and Stocks Likely Impacted by the Specified Activities¹

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) ²	Stock abundance (CV, N _{min} , most recent abundance survey) ³	PBR	Annual M/SI ⁴
Odontoceti (toothed whales, dolphins, and porpoises)						
<i>Family Delphinidae</i>						
Bottlenose dolphin	<i>Tursiops truncatus</i>	Gulf of Mexico, Continental Shelf	-/-; N	0.11; 57,917; 2017-2018	556	65
Bottlenose dolphin	<i>Tursiops truncatus</i>	Gulf of Mexico, Western Coastal	-/-; N	0.13; 18,585; 2017-2018	167	36

¹ Information on the classification of marine mammal species can be found on the web page for The Society for Marine Mammalogy's Committee on Taxonomy (<https://marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/>; Committee on Taxonomy (2022)).

² Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.

³ NMFS marine mammal stock assessment reports online at:

<https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments>. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance.

⁴ These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (e.g., commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range.

As indicated above, one species (two managed stocks) in Table 3 temporally and spatially co-occur with the activity to the degree that take is reasonably likely to occur.

All species that could potentially occur in the proposed project area are included in Table 3 of the IHA application. While Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (northern GOM Oceanic Stock), pantropical spotted dolphin (*Stenella attenuata*), Rice's whale (*Balaenoptera ricei*), Risso's dolphin (*Grampus griseus*), and sperm whale (*Physeter microcephalus*) have been documented in the region (see application Section 6 – Table 6-8), the temporal and/or spatial occurrence of these species is such that take is not expected to occur, and they are not discussed further beyond the explanation provided here.

Bottlenose Dolphin

Bottlenose dolphins are present year-round in the nearshore waters of the GOM and are expected to have a common occurrence within the vicinity of the project area. There are two distinct bottlenose dolphin morphotypes: migratory coastal and offshore, and the population of bottlenose dolphins in the GOM consists of a complex mosaic of 38 stocks of bottlenose dolphin (Waring *et al.*, 2010). This includes 33 bay, sound, and estuary stocks in the inshore waters; three coastal stocks (western, northern, eastern); the northern GOM Continental Shelf Stock; and the northern GOM Oceanic Stock (Waring *et al.*, 2013). Of those, only two stocks are reasonably expected near the project area: the GOM Western Coastal Stock and the northern GOM Continental Shelf Stock. The northern GOM Oceanic Stock is not likely to occur within the project area because the stock range is defined as extending from the 200-m isobath of the GOM south toward the seaward extent of the Exclusive Economic Zone (Hayes *et al.*, 2022) and, therefore, is not discussed further.

Bottlenose dolphins under the GOM Western Coastal Stock have the possibility to occur within the vicinity of the project area as this stock range is defined as the Mississippi River Delta to the U.S.-Mexico border, in waters typically less than 20 m (66 ft) deep along the inner continental shelf (within 7.5 km (4.6 miles) of shore; Hayes *et al.*, 2022). Bottlenose dolphins under the northern GOM Continental Shelf Stock are likely to occur within the project area as well, as this stock inhabits waters from 20-200 m (66-656 ft) deep throughout the U.S. GOM. There are two biologically important areas for bottlenose dolphins north of the project area in Caminada Bay and Barataria Bay, Louisiana, but neither project staging nor implementation are expected to impact these areas.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately

assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007, 2019) recommended that marine mammals be divided into hearing groups based on directly measured (behavioral or auditory evoked potential techniques) or estimated hearing ranges (behavioral response data, anatomical modeling, *etc.*). Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.*, low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approx. 65 dB threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 4.

Table 4. Marine Mammal Hearing Groups (NMFS, 2018)

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, <i>Kogia</i> , river dolphins, Cephalorhynchid, <i>Lagenorhynchus cruciger</i> & <i>L. australis</i>)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz
* Represents the generalized hearing range for the entire group as a composite (<i>i.e.</i> , all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall <i>et al.</i> 2007) and PW pinniped (approximation).	

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an

extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.*, 2006; Kastelein *et al.*, 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information.

Potential Effects of Specified Activities on Marine Mammals and their Habitat

This section provides a discussion of the ways in which components of the specified activity may impact marine mammals and their habitat. The **Estimated Take** section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The **Negligible Impact Analysis and Determination** section considers the content of this section, the **Estimated Take** section, and the **Proposed Mitigation** section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and whether those impacts are reasonably expected to, or reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

Acoustic effects on marine mammals during the specified activities can occur from impact pile driving. The effects of underwater noise from the NFE's proposed activities have the potential to result in Level A or Level B harassment of marine mammals in the action area.

For general information on sound, its interaction with the marine environment, and a description of acoustic terminology, please see, *e.g.*, ANSI (1986, 1995), Au and Hastings (2008), Hastings and Popper (2005), Mitson (1995), NIOSH (1998), Richardson *et al.* (1995), Southall *et al.* (2007), and Urick (1983). Underwater sound from active acoustic sources can cause one or more of the following: temporary or permanent hearing impairment, behavioral disturbance, masking, stress, and non-auditory physical effects.

The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure.

Threshold Shifts

Marine mammals exposed to high-intensity sound, or to lower-intensity sound for prolonged periods, can experience hearing threshold shift (TS), which is the loss of hearing sensitivity at certain frequency ranges (Finneran, 2015). TS can be permanent (PTS; permanent threshold shift), in which case the loss of hearing sensitivity is not fully recoverable, or temporary (TTS; temporary threshold shift), in which case the animal's hearing threshold would recover over time (Southall *et al.*, 2007).

When PTS occurs, there is physical damage to the sound receptors in the ear (*i.e.*, tissue damage), whereas TTS represents primarily tissue fatigue and is reversible (Southall *et al.*, 2007). In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.*, Ward, 1997). Therefore, NMFS does not consider TTS to constitute auditory injury. Behavioral disturbance to marine mammals from sound may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors. Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin, beluga whale (*Delphinapterus leucas*), harbor porpoise (*Phocoena phocena*), and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)), and five species of pinnipeds exposed to a limited number of sound sources (*i.e.*, mostly tones and octave-band noise) in laboratory settings (Finneran, 2015). At low frequencies, onset-TTS exposure levels are higher compared to those in the region of best sensitivity (*i.e.*, a low frequency noise would need to be louder to cause TTS onset when TTS exposure level is higher), as shown for harbor porpoises and harbor seals (*Phoca vitulina*; Kastelein *et al.*, 2019a, 2019b, 2020a, 2020b). In addition, TTS can accumulate across multiple exposures, but the resulting TTS would be less than the TTS from a single, continuous exposure with the same SEL (Finneran *et al.*, 2010; Kastelein *et al.*, 2014; Kastelein *et al.*, 2015; Mooney *et al.*, 2009). This means that TTS predictions based on the total, cumulative SEL would overestimate the amount of TTS from intermittent exposures such as sonars and impulsive sources.

The potential for TTS from impact pile driving exists. After exposure to playbacks of impact pile driving sounds (rate 2,760 strikes/hr) in captivity, mean TTS increased from 0 dB after 15 min exposure to 5 dB after 360 min exposure; recovery occurred within 60 min (Kastelein *et al.*, 2016). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. No data are available on noise-induced hearing loss for mysticetes. Nonetheless, what we considered herein is the best available science. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007, 2019) and Finneran (2015), and Table 5 in NMFS (2018).

In-water construction activities associated with this project would include impact pile driving to install 26 steel piles over 9 days. The sounds produced by this activity are considered impulsive and intermittent. Impulsive sounds are typically transient, brief

(less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI, 1986; NIOSH, 1998; NMFS, 2018). There would likely be pauses in activities producing the sound during each day. Given these pauses and the fact that many marine mammals are likely moving through the project area and not remaining for extended periods of time, the potential for TS declines.

Behavioral Harassment

Exposure to noise from pile driving also has the potential to behaviorally disturb marine mammals. Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.*, Lusseau and Bejder, 2007; Weilgart, 2007; NRC, 2005).

Disturbance may result in changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); or avoidance of areas where sound sources are located. Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.*, Richardson *et al.*, 1995; Wartzok *et al.*, 2004; Southall *et al.*, 2007; Weilgart, 2007; Archer *et al.*, 2010; Southall *et al.*, 2021). Behavioral reactions can vary not only among

individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.*, 2012), and can vary depending on characteristics associated with the sound source (*e.g.*, whether it is moving or stationary, number of sources, distance from the source). Please see Appendices B and C of Southall *et al.* (2007) as well as Nowacek *et al.* (2007); Ellison *et al.* (2012), and Gomez *et al.* (2016) for a review of studies involving marine mammal behavioral responses to sound.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.*, bubble nets, sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.*, Croll *et al.*, 2001; Nowacek *et al.*, 2004; Madsen *et al.*, 2006; Yazvenko *et al.*, 2007; Melcón *et al.*, 2012). In addition, behavioral state of the animal plays a role in the type and severity of a behavioral response, such as disruption to foraging (*e.g.*, Sivle *et al.*, 2016; Wensveen *et al.*, 2017). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal (Goldbogen *et al.*, 2013).

The likely or possible impacts of NFE's proposed activities on marine mammals could be generated from both non-acoustic and acoustic stressors. Potential non-acoustic stressors include the physical presence of the equipment and vessels; however, we expect that any animals that approach the project site close enough to be harassed due to the presence of equipment would be within the Level B harassment zones for pile driving and

would already be subject to harassment from the in-water activities. Therefore, any impacts to marine mammals are expected to be primarily acoustic and generated by heavy equipment operation during pile installation (*i.e.*, impact driving). Impact hammers would be used to complete in-water construction and may act as an acoustic stressor. Impact hammers operate by repeatedly dropping and/or pushing a heavy piston onto a pile to drive the pile into the substrate. Sound emitted by impact pile driving would be temporary and localized. Due to the relatively limited area of impact compared to the extensive available surrounding habitat, potential impacts from sound are anticipated to be negligible on marine mammal habitat.

Marine Mammal Habitat Effects

NFE's proposed construction activities could have localized, temporary impacts on marine mammal habitat, including prey, by increasing in-water sound pressure levels and slightly decreasing water quality. Increased noise levels may affect acoustic habitat and adversely affect marine mammal prey in the vicinity of the project area (see discussion below). During impact pile driving, elevated levels of underwater noise would ensonify the project area where both fishes and mammals occur, and could affect foraging success. Additionally, marine mammals may avoid the area during construction, however, displacement due to noise is expected to be temporary and is not expected to result in long-term effects to the individuals or populations. Construction activities are expected to be of short duration (9 days total) and would likely have temporary impacts on marine mammal habitat through increases in underwater sound.

In-Water Construction Effects on Potential Foraging Habitat

A temporary and localized increase in turbidity near the seafloor would occur in the immediate area surrounding the location where piles are installed. In general, turbidity associated with pile installation is localized to an approx. 25-ft (7.6-m) radius around the pile (Everitt *et al.*, 1980). Cetaceans are not expected to be close enough to the

pile driving areas to experience effects of turbidity. Such impact-producing factors may provoke mobile prey species to leave the area of activity and/or cause injury or mortality in less mobile species. This may indirectly inhibit marine mammal foraging activities within the project area. Project impacts to marine mammal prey species are expected to be minor and limited to short-term changes that may result in potential prey avoidance of the project area during construction. Marine mammals and prey species impacted by impact pile driving activities are expected to return to normal behavior shortly after the conclusion of pile driving operations, and return to areas of available habitat immediate proximity to the area around the impact pile driving activities; therefore, impacts to habitat are considered negligible and not discussed further.

The area likely impacted by impact pile driving (0.2 acres) for this project (441.5 acres) is relatively small compared to the total available habitat in the waters off Louisiana in the northern GOM. The proposed project area is highly influenced by anthropogenic activities, and provides limited foraging habitat for marine mammals. Furthermore, pile driving at the proposed project site would not obstruct long-term movements or migration of marine mammals.

Avoidance by potential prey (*i.e.*, fish) of the immediate area due to the temporary loss of this foraging habitat is also possible. The duration of fish and marine mammal avoidance of this area after pile driving stops is unknown, but a return to normal recruitment, distribution, and behavior is anticipated. Any behavioral avoidance by prey of the disturbed area would still leave significantly large areas of potential foraging habitat in the nearby vicinity.

In-water Construction Effects on Potential Prey

Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.*, crustaceans, cephalopods, fish, zooplankton, other

marine mammals). Marine mammal prey varies by species, season, and location. Here, we describe studies regarding the effects of noise on known marine mammal prey.

Fish utilize the soundscape and components of sound in their environment to perform important functions such as foraging, predator avoidance, mating, and spawning (*e.g.*, Zelick and Mann, 1999; Fay, 2009). Depending on their hearing anatomy and peripheral sensory structures, which vary among species, fishes hear sounds using pressure and particle motion sensitivity capabilities and detect the motion of surrounding water (Fay *et al.*, 2008). The potential effects of noise on fishes depends on the overlapping frequency range, distance from the sound source, water depth of exposure, and species-specific hearing sensitivity, anatomy, and physiology. Key impacts to fishes may include behavioral responses, hearing damage, barotrauma (pressure-related injuries), and mortality.

Fish react to sounds which are especially strong and/or intermittent low-frequency sounds, and behavioral responses such as flight or avoidance are the most likely effects. Short duration, sharp sounds (*e.g.*, impulsive) can cause overt or subtle changes in fish behavior and local distribution. The reaction of fish to noise depends on the physiological state of the fish, past exposures, motivation (*e.g.*, feeding, spawning, migration), and other environmental factors. Hastings and Popper (2005) identified several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented effects of pile driving on fish; several are based on studies in support of large, multiyear bridge construction projects (*e.g.*, Scholik and Yan, 2001, 2002; Popper and Hastings, 2009). Many studies have demonstrated that impulsive sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (*e.g.*, Fewtrell and McCauley, 2012; Pearson *et al.*, 1992; Skalski *et al.*, 1992; Santulli *et al.*, 1999; Paxton *et al.*, 2017). However, some studies

have shown no or slight reaction to impulse sounds (*e.g.*, Pena *et al.*, 2013; Wardle *et al.*, 2001; Jorgenson and Gyselman, 2009; Popper *et al.*, 2005).

Sound pressure levels (SPLs) of sufficient strength have been known to cause injury to fish and fish mortality. However, in most fish species, hair cells in the ear continuously regenerate and loss of auditory function likely is restored when damaged cells are replaced with new cells. Halvorsen *et al.* (2012a) showed that a TTS of 4-6 dB was recoverable within 24 hr for one species. Impacts would be most severe when the individual fish is close to the source and when the duration of exposure is long. Injury caused by barotrauma can range from slight to severe and can cause death, and is most likely for fish with swim bladders. Barotrauma injuries have been documented during controlled exposure to impact pile driving (Halvorsen *et al.*, 2012b; Casper *et al.*, 2013).

The most likely impact to fishes from pile driving activities at the project area would be temporary behavioral avoidance of the area. In general, impacts to marine mammal prey species are expected to be minor and temporary. Further, it is anticipated that preparation activities for pile driving and upon initial startup of equipment would cause fish to move away from the affected area where injuries may occur. Therefore, relatively small portions of the proposed project area would be affected for short periods of time and the potential for effects on fish to occur would be temporary and limited to the duration of sound-generating activities (*i.e.*, impact pile driving).

In summary, given the short daily duration of sound associated with individual pile driving events and the relatively small areas being affected, pile driving activities associated with the proposed actions are not likely to have a permanent, adverse effect on any fish habitat or populations of fish species. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas for fish and marine mammal foraging in the nearby vicinity. Thus, we conclude that impacts of the specified activities are not likely to have more than short-term adverse effects on any prey habitat or

populations of prey species. Further, any impacts to marine mammal habitat are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations.

Estimated Take of Marine Mammals

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of "small numbers," and the negligible impact determinations.

Harassment is the only type of take expected to result from these activities. Authorized takes would be by Level B harassment only, in the form of disruption of behavioral patterns for individual marine mammals resulting from exposure to the acoustic source (*i.e.*, impact pile driving). Based on the nature of the activity and the anticipated effectiveness of the mitigation measures (*i.e.*, single big bubble curtain, visual monitoring, ramp-up, power down, shutdown) discussed in detail below in the **Proposed Mitigation** section, Level A harassment is neither anticipated nor proposed to be authorized.

As described previously, no serious injury or mortality is anticipated or proposed to be authorized for this activity. Below we describe how the proposed take numbers are estimated.

For acoustic impacts, generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) the number of days of activities. We note that while these factors can contribute to a basic calculation to provide an initial prediction of potential takes, additional information that can qualitatively inform take estimates is also sometimes

available (*e.g.*, previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimates.

Acoustic Thresholds

NMFS recommends the use of acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment – Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source or exposure context (*e.g.*, frequency, predictability, duty cycle, duration of the exposure, signal-to-noise ratio, distance to the source), the environment (*e.g.*, bathymetry, other noises in the area, predators in the area), and the receiving animals (hearing, motivation, experience, demography, life stage, depth) and can be difficult to predict (*e.g.*, Southall *et al.*, 2007, 2021, Ellison *et al.*, 2012). Based on what the available science indicates and the practical need to use a threshold based on a metric that is both predictable and measurable for most activities, NMFS typically uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS generally predicts that marine mammals are likely to be behaviorally harassed in a manner considered to be Level B harassment when exposed to underwater anthropogenic noise above root-mean-squared pressure received levels (RMS SPL) of 120 dB (referenced to 1 microPascal (re 1 μ Pa)) for continuous (*e.g.*, vibratory pile driving, drilling) and above RMS SPL 160 dB re 1 μ Pa for non-explosive impulsive (*e.g.*, seismic airguns) or intermittent (*e.g.*, scientific sonar) sources. Generally speaking, Level B harassment take estimates based on these behavioral harassment thresholds are expected to include any likely takes by TTS as, in most cases, the likelihood of TTS occurs at distances from the source less than those at which

behavioral harassment is likely. TTS of a sufficient degree can manifest as behavioral harassment, as reduced hearing sensitivity and the potential reduced opportunities to detect important signals (conspecific communication, predators, prey) may result in changes in behavior patterns that would not otherwise occur.

NFE's proposed activity includes the use of an impulsive (*i.e.*, impact pile driving) source and, therefore, the RMS SPL thresholds of 160 dB re 1 μ Pa is applicable.

Level A harassment – NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). NFE's proposed activity includes the use of an impulsive (*i.e.*, impact pile driving) source.

These thresholds are provided in Table 5. The references, analysis, and methodology used in the development of the thresholds are described in NMFS' 2018 Technical Guidance, which may be accessed at:

www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.

Table 5. Thresholds Identifying the Onset of Permanent Threshold Shift

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	<i>Cell 1</i> $L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	<i>Cell 2</i> $L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	<i>Cell 3</i> $L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	<i>Cell 4</i> $L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	<i>Cell 5</i> $L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	<i>Cell 6</i> $L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	<i>Cell 7</i> $L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	<i>Cell 8</i> $L_{E,PW,24h}$: 201 dB

	PTS Onset Acoustic Thresholds* (Received Level)	
Hearing Group	Impulsive	Non-impulsive
	<i>Cell 9</i>	<i>Cell 10</i>
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB
<p>* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.</p> <p><i>Note:</i> Peak sound pressure (L_{pk}) has a reference value of 1 μPa, and cumulative sound exposure level (L_E) has a reference value of 1 μPa²s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript “flat” is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (<i>i.e.</i>, varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.</p>		

Ensonified Area

Here, we describe operational and environmental parameters of the activity that are used in estimating the area ensonified above the acoustic thresholds, including empirical sound source levels, and underwater sound propagation modeling.

The sound field in the project area is the existing background noise plus additional construction noise from the proposed project. Marine mammals are expected to be affected by sound generated by the primary component of the project (*i.e.*, impact pile driving).

Empirical sound source modeling was developed by Tetra Tech, Inc., based on literature, engineering guidelines, and underwater source measurements and acoustic modeling assessments of similar equipment and activities. These data were then used in propagation modeling completed by NFE. The empirical model calculation methodology is described in detail (see Appendix C in the Underwater Acoustic Assessment of the application) for impact piling, and that methodology was used to determine the L_{pk} and SEL sound source levels for the impact piling activities. A summary of construction

scenarios included in the acoustic modeling analysis is provided in Table 5-1 of the Underwater Acoustic Assessment of the application.

Underwater sound propagation modeling was completed by NFE using *dBSea* (Marshall Day Acoustics) for the prediction of underwater noise using bathymetry data and “placing” noise sources (*i.e.*, platform pile driving location) in the modeled environment (see the Underwater Acoustic Assessment in the application). The scenarios modeled were ones where potential underwater noise impacts of impact pile driving on marine species were assessed, and noise mitigation methods were also included. To examine results in more detail, levels may be plotted in cross sections, or a detailed spectrum may be extracted at any point in the calculation area. Levels were calculated in third octave bands from 12.5 hertz (Hz) to 20 kilohertz (kHz). The accuracy of underwater sound propagation modeling results is largely dependent on the sound source characteristics and the accuracy of data inputs and assumptions used to describe the medium between the path and receiver. The representative acoustic modeling scenarios were derived from descriptions of the expected construction activities and operational conditions through consultations between the project design and engineering teams from NFE.

The impact pile driving scenarios were modeled using a vertical array of point sources spaced at 1 m intervals, distributing the sound emissions from pile driving throughout the water column. The vertical array was assigned third-octave band sound characteristics adjusted for site-specific parameters, including expected hammer energy and number of blows. Third octave band center frequencies from 12.5 Hz up to 20 kHz were used in the modeling. The scenarios modeled were impact pile driving for a fixed-jacket design associated with the three fixed-jacket platforms (P4, P5, P6; Table 6). To be conservative, it was assumed the maximum rated hammer energy of 1,380 kJ would be employed for all of the impact piling scenarios.

The underwater acoustic modeling analysis used a split solver, with dBSeaPE (Parabolic Equation Method) evaluating the low frequency (12.5 – 800 Hz) range and dBSeaRay (Ray Tracing Method) addressing the high frequency (1 – 20 kHz) range. The dBSeaPE solver uses the range-dependent acoustic model parabolic equation method, a versatile and robust method of marching the sound field out in range from the sound source. This method is widely used in the underwater acoustics community. The dBSeaRay solver forms a solution by tracing rays from the source to the receiver. Many rays leave the source covering a range of angles, and the sound level at each point in the receiving field is calculated by coherently summing the components from each ray. This is currently the only computationally efficient method at high frequencies.

Table 6. Underwater Acoustic Modeling Scenarios - Pile Installation

Platform	Activity description	Duration of pile installation (minutes)	Total hammer blows (based on total piles per day)	Location (UTM coordinates) for modeling locations	Sound source level (peak sound pressure)	Sound source level (cumulative sound exposure over 24-hour period)	Sound source level (root mean square sound pressure)
P4	4 piles per day (12 piles total)	190	5,684	223,049 m, 3,219,466 m	236	210	220
P5	8 pile segments per day (8 piles total)	238	7,144	222,890 m, 3,219,450 m	236	210	220
P6	6 pile segments per day (6 piles total)	122	5,358	223,176 m, 3,219,585 m	236	210	220

Note: All piles are 108 in (2.743 m) diameter piles. Maximum hammer energy is 1,380 kJ.

To calculate distances to the Level A harassment and Level B harassment thresholds for the methods and piles being used in this project, a maximum received level-over-depth approach was used by NFE. This approach uses the maximum received level that occurs within the water column at each sampling point. Both the maximum range at which the sound level was calculated in the model (R_{\max}) and the maximum range at which a sound level was calculated excluding five percent of the R_{\max} ($R_{95\%}$) were calculated for each of the regulatory thresholds. The $R_{95\%}$ excludes major outliers or protruding areas associated with the underwater acoustic modeling environment. Regardless of shape of the calculated isopleths, the predicted range encompasses at least 95 percent of the area that would be exposed to sound at or above the specified level. All distances to injury thresholds are presented in terms of the $R_{95\%}$ range. The calculated values for all three platforms were comparable (Tables 7, 8, 9), which is expected given the similar water depths, benthic conditions, bathymetry, and sound speed profile influences resulting from the sites' close proximity to one another.

For purposes of calculating and requesting take, NFE used the 6 dB attenuated isopleths associated with the use of a single big bubble curtain with a minimum airflow rate of $0.3 \text{ m}^3/\text{min} \cdot \text{m}$ (see **Proposed Mitigation**). A single bubble curtain with an airflow rate of $0.3 \text{ m}^3/\text{min} \cdot \text{m}$ can achieve 8-14 dB reduction when deployed on the seafloor at a depth of 30 m (98 ft; Koschinski and Ludemann, 2020). Available single big bubble curtains, operating with an airflow rate of $0.5 \text{ m}^3/\text{min} \cdot \text{m}$, are documented to achieve a minimum of 10 dB reduction in sound propagation (Bellmann *et al.*, 2020). To be conservative in determination of take estimations, a 6 dB mitigation level was chosen.

Table 7. Marine Mammal Injury and Behavioral Onset Criteria Threshold Distances (meters) for Pile Driving at P4 Location

Hearing group	Metric	Threshold (dB)	Distance (m) without attenuation	Distance (m) with 6 dB attenuation
LF cetaceans	Cumulative sound exposure over 24-hour period $L_{E,24hr}$	183	3,929	2,010
LF cetaceans	Peak sound pressure $L_{p,pk}$	219	39	23
MF cetaceans	Cumulative sound exposure over 24-hour period $L_{E,24hr}$	185	116	46
MF cetaceans	Peak sound pressure $L_{p,pk}$	230	11	NA*
Marine mammal behavior	Root mean square sound pressure L_p	160	3,208	1,560

* The threshold level is greater than the source level, therefore, distances are not generated.

Table 8. Marine Mammal Injury and Behavioral Onset Criteria Threshold Distances (meters) for Pile Driving at P5 Location

Hearing group	Metric	Threshold (dB)	Distance (m) without attenuation	Distance (m) with 6 dB attenuation
LF cetaceans	Cumulative sound exposure over 24-hour period $L_{E,24hr}$	183	4,558	2,249
LF cetaceans	Peak sound pressure $L_{p,pk}$	219	39	24
MF cetaceans	Cumulative sound exposure over 24-hour period $L_{E,24hr}$	185	132	70
MF cetaceans	Peak sound pressure $L_{p,pk}$	230	12	NA*
Marine mammal behavior	Root mean square sound pressure L_p	160	3,037	1,582

* The threshold level is greater than the source level, therefore, distances are not generated.

Table 9. Marine Mammal Injury and Behavioral Onset Criteria Threshold Distances (meters) for Pile Driving at P6 Location

Hearing group	Metric	Threshold (dB)	Distance (m) without attenuation	Distance (m) with 6 dB attenuation
LF cetaceans	Cumulative sound exposure over 24-hour period $L_{E,24hr}$	183	3,908	1,887
LF cetaceans	Peak sound pressure $L_{p,pk}$	219	39	24
MF cetaceans	Cumulative sound exposure over 24-hour period $L_{E,24hr}$	185	111	45
MF cetaceans	Peak sound pressure $L_{p,pk}$	230	11	NA*
Marine mammal behavior	Root mean square sound pressure L_p	160	3,141	1,603

* The threshold level is greater than the source level, therefore, distances are not generated.

Marine Mammal Occurrence

In this section we provide information about the occurrence of marine mammals, including density or other relevant information that will inform the take calculations.

As discussed previously, given the project location in relatively shallow shelf waters in the western GOM and brief project duration, take is expected for only the bottlenose dolphin. However, NFE provided quantitative analysis for additional species that rarely occur in shelf waters and/or ESA-listed species (Rice's whales and sperm whales). These analyses, shown in Table 10, confirmed that no take is reasonably expected to occur for species other than bottlenose dolphin.

Marine mammal density estimates are based on the most recent marine mammal species distribution data for the GOM (Litz *et al.*, 2022). While there are multiple sources of information in this region (e.g., Roberts *et al.*, 2016; Hayes *et al.*, 2022; Maze-Foley and Mullin, 2006)), the most recent information (Litz *et al.*, 2022) was used in take estimation calculations.

Take Estimation

Here we describe how the information provided above is synthesized to produce a quantitative estimate of the take that is reasonably likely to occur and proposed for authorization.

Potential take calculations were based on annual species density within the project area, given the dates during which impact pile driving would occur (May–August). Bottlenose dolphins are the only marine mammal species with calculated take, and is the only marine mammal species for which authorization of take is proposed. No take by Level A harassment is anticipated during impact pile driving.

Table 10. Average Marine Mammal Densities Used in Exposure Estimates and Estimates of Calculated Takes by Level A and Level B Harassment due to Impact Pile Driving

Species	Stock	Average seasonal density (per 100 km ²)	Take by Level A harassment at P4	Take by Level B harassment at P4	Take by Level A harassment at P5	Take by Level B harassment at P5	Take by Level A harassment at P6	Take by Level B harassment at P6
Atlantic spotted dolphin	GOM	0.247	0	0	0	0	0	0
Bottlenose dolphin	GOM	149.159	0	15	0	15	0	16
Pantropical spotted dolphin	GOM	0.000	0	0	0	0	0	0
Rice's whale	GOM	0	0	0	0	0	0	0
Risso's dolphin	GOM	0	0	0	0	0	0	0
Sperm whale	GOM	0	0	0	0	0	0	0

Note: Cetacean density values from the NOAA Southeast Fisheries Science Center (Litz *et al.*, 2022). Bottlenose dolphin density values not identified to stock.

Bottlenose dolphin density information is not differentiated by individual stock (Litz *et al.*, 2022). Given the difficulty of bottlenose dolphin identification in the field, it has been assumed that the total calculated take of bottlenose dolphins could accrue to either the western coastal stock or the continental shelf stock. Take calculations presented in Table 10 indicate that bottlenose dolphins may be present during construction activities, but do not account for average group sizes. Average pod size is assumed to be 20 individuals (Maze-Foley and Mullin, 2006). Due to the likelihood that bottlenose dolphins may be present during construction activities, one pod of bottlenose dolphins was assumed to potentially be present per each day of impact pile driving; therefore, the total number of days (9) was multiplied by the average group size (20) to produce the proposed take number for authorization (Table 11).

Table 11. Average Marine Mammal Densities Used in Exposure Estimates and Estimates of Requested Takes by Level B Harassment due to Impact Pile Driving

Species	Stock	Take by Level B harassment at P4	Take by Level B harassment at P5	Take by Level B harassment at P6	Total Level B take ³	Percent population
Bottlenose dolphin ^{2, 3}	Western Coastal	60	60	60	180	0.3
Bottlenose dolphin ^{2, 3}	Continental Shelf					

Note: Given the difficulty of visual identification in the field for bottlenose dolphins, it has been assumed the calculated take could be accrued to either the GOM Western Coastal stock or the northern GOM Continental Shelf stock.

¹ Cetacean density values from Litz *et al.* (2022).

² Bottlenose dolphin density value from Litz *et al.* (2022) reported for the entire GOM are presented. Estimated take is listed as the total over 3 days of activity at each platform (9 days total).

³ Bottlenose dolphin estimated take was adjusted to account for one group size of 20 individuals per day for 9 days of construction (Maze-Foley and Mullin, 2006).

Proposed Mitigation

In order to issue an IHA under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to the activity, and other means of effecting the least practicable impact on the species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting the activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, NMFS considers two primary factors:

- 1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned); and,
- 2) The practicability of the measures for applicant implementation, which may consider such things as cost, and impact on operations.

Single Big Bubble Curtain

NFE would employ a single big bubble curtain with a minimum airflow rate of 0.3 m³/min*m. In a big bubble curtain system, the entire construction site (installation vessel and foundation structure) is enveloped by a nozzle hose deployed in a complete circle at a specified distance from the site of pile driving on the sea floor. The hose is perforated through which air is forced creating an air bubble curtain that encloses the construction site (Bellmann *et al.*, 2020).

Pile Driving Weather and Time Restrictions

Pile driving would commence only during daylight hours no earlier than one hour after (civil) sunrise. Pile driving would not be initiated later than 1.5 hr before (civil) sunset. Pile driving may continue after dark when the installation of the same pile began during daylight hours (1.5 hr before (civil) sunset) and must proceed for human safety or installation feasibility reasons. Pile driving will not be initiated in times of low visibility when the shutdown zone for MF cetaceans (500 m) cannot be visually monitored, as determined by the lead PSO on duty.

Protected Species Observers (PSOs)

The placement of four PSOs during all pile driving activities (described in the **Proposed Monitoring and Reporting** section) would ensure the shutdown zone is visible in good conditions. Visual monitoring of the established zone would be performed by qualified and NMFS–approved third-party PSOs.

Harassment and Shutdown Zones

The harassment and shutdown zones would be established and continuously monitored by PSOs during impact pile driving to minimize impacts to marine mammals. NMFS proposes to require the 500-m shutdown zone. This zone is expanded from the largest estimated Level A harassment zone (70 m) under the 6 dB reduction scenario in order to provide a conservative monitoring area for purposes of potential shutdown of activity (see below).

Ramp-Up Procedures

NFE would implement a “ramp-up” technique when impact pile driving with the maximum hammer energy limited to 60 percent. The ramp up technique requires an initial 30 min using a reduced hammer energy and involves initially driving a pile using a low hammer energy and, as the pile is driven further into the soil, the hammer energy is increased as necessary to achieve desired soil penetration. A ramp up would occur at the beginning of the impact pile driving of each pile and at any time following the cessation of impact pile driving of 30 min or longer.

Shutdown and Power-Down Procedures

The shutdown zone around the pile driving activities would be maintained by four PSOs, as previously described, for the presence of marine mammals before, during, and after pile driving activity. For pile driving, from an engineering standpoint, any significant stoppage of driving progress may allow time for displaced sediments along the pile surface areas to consolidate and bind. Attempts to restart the driving of a stopped pile may be unsuccessful and create a situation where a pile is permanently bound in a partially driven position. If a marine mammal is observed entering or within the shutdown zone after pile driving has commenced, a shutdown of pile driving would occur when practicable as determined by the lead engineer on duty, who must evaluate the following:

- Use of site-specific soil data and real-time hammer log information to judge whether a stoppage would risk causing pile refusal at restart of pile; and,
- Confirmation that pile penetration is deep enough to secure pile stability in the interim situation, taking into account weather statistics for the relevant season and the current weather forecast.

Determination by the lead engineer on duty would be made for each pile as the installation progresses and not for the site as a whole. If a shutdown is called for but the

lead engineer determines shutdown is not practicable due to an imminent risk of injury or loss of life to an individual, or risk of damage to a vessel that creates risk of injury or loss of life for individuals, reduced hammer energy (power-down) would be implemented when the lead engineer determines it is practicable.

Subsequent restart/increased power of the equipment can be initiated if the animal has been observed exiting the shutdown zone within 30 min of the shutdown, or, after an additional time period has elapsed with no further sighting of the animal that triggered the shutdown (*i.e.*, 15 min for small odontocetes, 30 min for all other species). If pile driving shuts down for reasons other than mitigation (*e.g.*, mechanical difficulty) for brief periods (*i.e.*, less than 30 min), it may be activated again without a ramp up if PSOs have maintained constant observation and no detections of any marine mammal have occurred within the shutdown zone.

Based on our evaluation of the applicant's proposed measures, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104(a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present while conducting the activities. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.*, presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species with the activity; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas);
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and,
- Mitigation and monitoring effectiveness.

Visual Monitoring

Monitoring and reporting requirements are provided herein. Visual monitoring of the harassment zones, to the extent practicable, and established shutdown zone would be performed by a minimum of four qualified and NMFS–approved third-party PSOs. A visual observer team comprising NMFS–approved PSOs, operating in shifts, would be stationed aboard both the respective project vessel and a dedicated PSO vessel. PSO qualifications would include a science degree and direct field experience on a marine mammal observation vessel and/or aerial surveys in the Atlantic Ocean/GOM. All PSOs

would work in shifts such that no one monitor would work more than 4 consecutive hr without a consecutive 2-hr break or longer than 12 hr during any 24-hr period.

PSOs would be responsible for visually monitoring and identifying marine mammals approaching or entering the established harassment and shutdown zones during survey activities. It would be the responsibility of a designated lead PSO on duty to communicate the presence of marine mammals as well as to communicate and enforce the action(s) that are necessary to ensure mitigation and monitoring requirements are implemented as appropriate. Observations from other PSOs would be communicated to the lead PSO on duty, who would then be responsible for implementing the necessary mitigation procedures.

PSOs would be equipped with binoculars and have the ability to estimate distances to marine mammals located in proximity to their established zones using range finders. Reticulated binoculars would also be available to PSOs for use as appropriate based on conditions and visibility to support the sighting and monitoring of marine species.

Data on all PSO observations would be recorded based on standard PSO collection requirements. This would include dates and locations of survey operations; time of observation, location and weather; details of the sightings (*e.g.*, species, age classification (if known), numbers, behavior), and details of any observed “taking” (behavioral disturbances or injury/mortality). The data sheet would be provided to NMFS for review and approval prior to the start of survey activities. In addition, prior to initiation of project activities, all crew members would undergo environmental training, a component of which would focus on the procedures for sighting and protection of marine mammals. A briefing would also be conducted between the survey supervisors and crews, the PSOs, and NFE. The purpose of the briefing would be to establish responsibilities of

each party, define the chains of command, discuss communication procedures, provide an overview of monitoring purposes, and review operational procedures.

During impact pile driving, visual monitoring would occur as follows using a minimum of four PSOs assigned to two different locations:

- A minimum of two PSOs must be on active duty at the pile driving vessel/platform from 60 min before, during, and for 30 min after all pile installation activity; and,
- A minimum of two PSOs must be on active duty on a dedicated PSO vessel from 60 min before, during, and for 30 min after all pile installation activity. The dedicated PSO vessel must be located at the best vantage point in order to observe and document marine mammal sightings in proximity to the shutdown zone.

Reporting

NFE will provide the following reporting as necessary during active pile driving activities:

- The applicant will report any observed injury or mortality as soon as feasible and in accordance with NMFS' standard reporting guidelines. Reports will be made by phone (305-361-4586) and by email (*blair.mase@noaa.gov* and *PR.ITP.MonitoringReports@noaa.gov*) and will include the following:
 - Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
 - Species identification (if known) or description of the animal(s) involved;
 - Condition of the animal(s) (including carcass condition if the animal is dead);
 - Observed behaviors of the animal(s), if alive;
 - If available, photographs or video footage of the animal(s); and,
 - General circumstances under which the animal was discovered.

- An annual report summarizing the prior year's activities will be provided that fully documents the methods and monitoring protocols, summarizes the data recorded during monitoring, estimates the number of listed marine mammals that may have been incidentally taken during project pile driving, and provides an interpretation of the results and effectiveness of all monitoring tasks. The annual draft report will be provided no later than 90 days following completion of construction activities. Any recommendations made by NMFS will be addressed in the final report, due after the IHA expires and including a summary of all monitoring activities, prior to acceptance by NMFS. Final reports will follow a standardized format for PSO reporting from activities requiring marine mammal mitigation and monitoring.
- All PSOs will use a standardized data entry format (see Appendix B PSO Standardized Data Entry of application).

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any impacts or responses (*e.g.*, intensity, duration), the context of any impacts or responses (*e.g.*, critical reproductive time or location, foraging impacts affecting energetics), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by

evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Level A harassment is extremely unlikely given the required mitigation measures designed to minimize the possibility of injury to marine mammals. No mortality is anticipated given the nature of the activity.

Pile installation activities have the potential to disturb or displace marine mammals. Specifically, the project activities may result in take, in the form of Level B harassment only, from underwater sounds generated from impact pile installation activities. Potential takes could occur if individuals move into the ensonified zones when these activities are underway. The takes from Level B harassment would be due to potential behavioral disturbance. The potential for harassment is minimized through the implementation of planned mitigation strategies.

Take would occur within a limited, confined area of each stock's range. Level B harassment would be reduced to the level of least practicable adverse impact through use of mitigation measures described herein. Further, the amount of take authorized is extremely small when compared to stock abundance (less than one percent for each stock).

No marine mammal stocks for which incidental take authorization is proposed are listed as threatened or endangered under the ESA or determined to be strategic or depleted under the MMPA. The employment of a single big bubble curtain for sound attenuation, large shutdown zone, and proposed monitoring make injury takes of marine mammals unlikely. The shutdown zone would be thoroughly monitored before the

proposed pile installation begins and activities would be postponed or hammer energy would be reduced (power down) if a marine mammal is sighted within the shutdown zone. There is a high likelihood that marine mammals would be detected by trained observers under environmental conditions described for the proposed project. NFE's plan to limit construction activities to daylight hours would also increase detectability of marine mammals in the area. Therefore, the proposed mitigation and monitoring measures are expected to eliminate the potential for Level A harassment as well as reduce the amount and intensity for Level B behavioral harassment.

Anticipated and authorized takes are expected to be limited to short-term Level B harassment (behavioral disturbance) as construction activities would occur over the course of 9 days. Individual animals, even if taken multiple times, would likely move away from the sound source and be temporarily displaced from the area due to elevated noise level during pile removal. Marine mammals could also experience TTS if they move into the Level B harassment zone. TTS is a temporary loss of hearing sensitivity when exposed to loud sound, and the hearing threshold is expected to recover completely within minutes to hours; thus, it is not considered an injury. While TTS could occur, it is not considered a likely outcome of this activity. In all, there would be no adverse impacts to the stocks as a whole.

The proposed project is not expected to have significant adverse effects on marine mammal habitat. There are no Biologically Important Areas or ESA-designated critical habitat within the project area. The activities may cause fish to leave the area temporarily, which could impact marine mammals' foraging opportunities in a limited portion of the foraging range. However, due to the short duration of activities and the relatively small area of affected habitat, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

In combination, we believe that these factors, as well as the available body of evidence from other similar activities, demonstrate that the potential effects of the specified activities would have only minor, short-term behavioral effects on individuals. The specified activities are not expected to impact reproduction or survival of any individual marine mammals, much less affect rates of recruitment or survival, and would therefore not result in population-level impacts.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect either of the stocks through effects on annual rates of recruitment or survival:

- No serious injury or mortality is anticipated or authorized;
- The specified activity and associated ensonified areas are small relative to the overall habitat ranges of the stocks;
- The applicant is required to implement mitigation measures to minimize impacts, such as a single big bubble curtain, ramp-up procedures, and implementation of shutdown zone, when practicable;
- Biologically important areas or critical habitat have not been identified within the project area; and,
- The lack of anticipated significant or long-term effects to marine mammal habitat.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity would have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted previously, only take of small numbers of marine mammals may be authorized under sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. When the predicted number of individuals to be taken is fewer than one-third of the species or stock abundance, the take is considered to be of small numbers. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

NMFS proposes to authorize incidental take by Level B harassment only of one marine mammal species with two managed stocks. The total amount of takes proposed for authorization relative to the best available population abundance is below one third of the estimated stock abundances and less than one percent for both stocks.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals would be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or

carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally whenever we propose to authorize take for endangered or threatened species.

No incidental take of ESA-listed species is proposed for authorization or expected to result from this activity. Therefore, NMFS has determined that formal consultation under section 7 of the ESA is not required for this action.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to NFE for conducting impact pile driving to support construction of liquefied natural gas platforms in waters off Grand Isle, Louisiana, from May 1, 2023, through April 30, 2024, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at:

<https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities>.

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this notice of proposed IHA. We also request comment on the potential renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform decisions on the request for this IHA or a subsequent renewal IHA.

On a case-by-case basis, NMFS may issue a one-time, one-year renewal IHA following notice to the public providing an additional 15 days for public comments when (1) up to another year of identical or nearly identical activities as described in the

Description of Proposed Activities section of this notice is planned or (2) the activities as described in the **Description of Proposed Activities** section of this notice would not

be completed by the time the IHA expires and a renewal would allow for completion of the activities beyond that described in the *Dates and Duration* section of this notice, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to the needed renewal IHA effective date (recognizing that the renewal IHA expiration date cannot extend beyond one year from expiration of the initial IHA).
- The request for renewal must include the following:
 - 1) An explanation that the activities to be conducted under the requested renewal IHA are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.*, reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take).
 - 2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

Upon review of the request for renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: March 20, 2023.

Kimberly Damon-Randall,

Director, Office of Protected Resources,

National Marine Fisheries Service.

